

PLANT KINGDOM

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AIR 1747

NCERT THREAD NOTES

(1) Artificial Classification System

By Linnaeus

Earliest classification system.

Uses only → Gross superficial morphological characters
↓
habitat colour number & shape of leaves

Based on mainly → Vegetative characters / Androecium structure

Drawbacks : The separated closely related species, bcz they were based on few characteristics.

This gives equal weightage to vegetative & sexual characteristics, but this is not acceptable as veg. characters are more easily affected by environment.

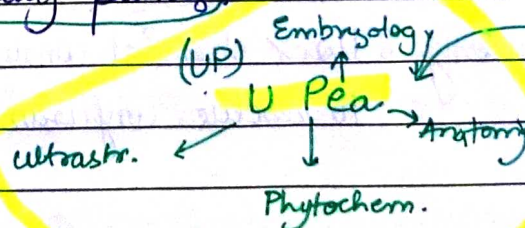
(2) Natural Classification System

By George Bentham & Joseph Dalton Hooker

Based on → natural affinities among the organism

Consider not only ^① external feature, but also the internal features

★ Given for flowering plants



At present,

(3) Phylogenetic Classification System.

Based on → evolutionary relationships b/w various organisms.
Assumption: Organisms belonging to the same taxa have a common ancestor.

We now use information from many other sources too to help resolve difficulties in classification. These become more important when there is no supporting fossil evidence.

- Numerical Taxonomy: Carried out using computers

Based on → All observable characteristics.
Number & codes to all characters
↓ then

Data is processed.

Hence, each character is given equal imp.
& at same time hundreds of characters are considered.

chromosome
↑
(Cyto) chromosome

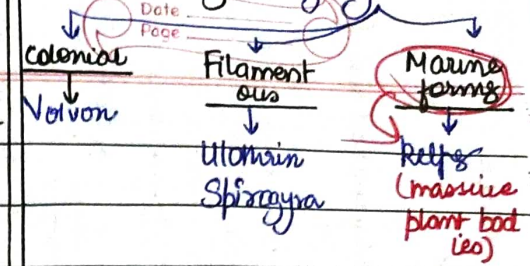
- Cytotaxonomy: Based on → Cytological information
 - Chromosome number
 - chromosome structure
 - chromosome behaviour

- Chemotaxonomy: Uses chemical constituents of the plant to resolve confusion.
↓
chemical constituents

ALGAE

- Chlorophyll bearing, Autotrophic
- Thauid
- Largely aquatic farm
 - fresh water
 - marine
- Various other habitat
 - moist stones
 - soils
 - wood.
- Associations :
 - Fungi → Lichen
 - Animals (Sloth, bear)

Form & Size: Highly Variable

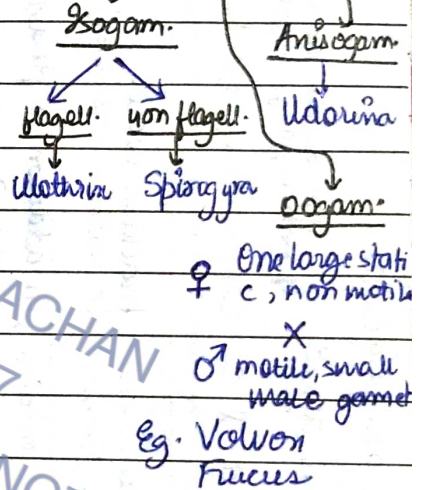


Reproduction

Vegetative
By Fragmentation
(fragment → thallus)

Asexual
Production of different types of spores.
Most common: Zoospores
(motile) flagellated
Ongerminat. → new

Sexual
By fusion of two gametes



★ Imp

① Depending on type of pigment &
② type of stored food algae
classified into three classes.
Red, Green, Brown algae

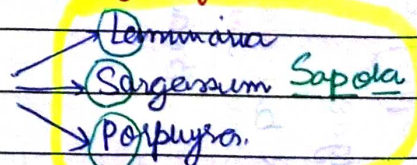
Uses : • At least half of the total CO_2 fixation on earth is carried out by algae through photosynthesis.

* Chlorella, unicellular alga rich in protein used as food supplement even by space travellers

They ↑ O_2 conc in the immediate surrounding

• Primary producers of energy : Forms the basis of life cycle of aquatic anim. (rich comp.)

• Among 70 species of marine algae used as food



• Certain marine prod large Brown algae
hydrocolloids (written holding subs) ← (algm) → used comm encially

Red algae

(Carrageen)

Gelidium, Gracilaria

Prepare ice creams & gelies ← Agar → Used to grow microbes

Chlorophyceae

Green Algae.

Chl. a & b (localised in dense green in colour chloroplast)

Fresh water, Brackish water
Salt water

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Store food : Oil droplet / Starch.

Cell wall : Rigid, Outer - Pectose
Inner - cellulose

Plant body : Unicellular

Colonial form encased

Chloroplast - Discoid, plate like, peripheral

Most of numerous spores are of ribbon shaped in diff. bodies pyrenoids in the chloroplast
Lentigin protein & starch

Vegetative Rep. - By fragmentation or

2-8, optical

By diff. types of spores

Asexual Rep. - by flagellated zoospore produced in zoosporangia

Sexual Rep. - considerable variation in the type & form of sex cells.

Isogam.

Anisogam.

Oogam.

Phaeophyceae

Brown algae.

depending on the amt of xanthophyll, fucoxanthin

Chl. a & c, Carotenoids, Xanthophyll
(Mayin colour from olive green to various shades of brown)

Fresh water (rare), brackish water
Salt water (Primarily in marine habitats)

Protoplast contains, in addition to plastids centrally located vacuole & nucleus

Complex carbohydrate → laminarin
→ Mannitol

Vegetative cells have a cellulose wall, usually covered on outside by a gelatinous coating of algin

They show great variation in size & form.

Range : Simple branched filamentous form (Ectocarpus) to profusely branched (Rhodospira) in (Reps - 100m g)

Attached to substratum by : holdfast
Stalk - stipe
leaf like phylloids organ - frond

Vegetative Rep. - By fragmentation

Asexual Rep. - By flagellated zoospore that are 2 unequal, laterally detached flagella.

2 unequal, laterally detached

Sexual Rep. - 1) Isog., 2) Anisog., 3) Oogam.

Fusion of gametes may form 2 unequal, laterally detached flagella.

Rhodophyceae

Red algae

Chl. a & d, 7-phycoerythrin (red pigment)

Fresh water (some), brackish water
Salt water (most) Majority red algae. Marine

Greater concentration in warmer waters, they occur in both

low light reg. → close to surface & water
dark / no light → great depths in (relatively) penumbra

Fluidic stem (similar to amylopectin & glycogen in structure)

cellulose, Pectin, polysulphate esters.

The red thalli of most of the red algae are multicellular. Some of them have a complex body organisation

Veg Rep. - By fragmentation

Asexual Rep. - By non-motile spore

Sexual Rep. - By non-motile gametes

accompanying by complex post fertilization development.

BRYOPHYTES

Masses
Liverworts

commonly grows in:
moist shaded areas
in the hills.

"Amphibians of the plant kingdom" because ^{Date} They can live in soil but dependent on water for sexual reproduction.

Location: Damp, humid & Shaded localities

★ Imp Role & Succession on bare Rocks/soil ★

Bryophyte body

more differentiated
than the algae

Decompose rocks: making substrate suitable for growth of higher plants.

Prevent erosion: Since mosses form dense mats on soil & reduce the impact of falling rain.

• Thallus-like

• Prostrate

• Erect

• Attached to substratum by: unicellular / multicellular rhizoids
(Liverworts) (Mosses).

Unbranched / Branched rhizoids

"They lack true roots, stems or leaves, but may possess 'root-like', 'leaf-like' or 'stem-like' structures."

Main Plant Body: Haploid $\xrightarrow{2}$ produce gametes $\xrightarrow{\text{so called}}$ Gametophyte.

"The sex organs in bryophytes are multicellular".

Male sex organ

Antheridium

↓ prod.

flagellate androzooids

Female sex org.

Archegonium (Flask shaped)

↓ prod.

Single egg

Zygote

Multicellular body "sporophyte".

produce

It does not undergo reduction division immediately.

↳ NOT free living but attached to the photosynth. gametophyte

Some cells of sporophyte

↓ undergo meiosis

Haploid spores

Gametophyte ← germinate

• Bryophytes in general of: Little economic importance

Some mosses: Provide food for herbaceous mammals, birds & other animals

Some species of *Sphagnum*: Provide peat → Fuel packaging material → transshipment of living material

* Mosses along with lichens are first organism to colonise rocks & hence of great ecological importance.

bag of their capacity to hold water

LIVERWORTS

Location: Moist, Shady habitats

- banks of streams
- moist ground
- damp soil
- base of trees
- deep in the woods

Plant body: Thalloid (eg. Marchantia)

- (1) Dorsiventral
 - (2) closely appressed to substrate.
- * Leafy members have tiny leaf like appendages in the nodes on stem-like structures.

Asexual Rep. → Fragmentation of thallus

OR
Formation of specialised str. called gemmae (sing. gemma)

detached from parent body and gemmae → to new individual.

- Green
- Multicellular
- Asexual buds
- Develop in the small receptacles located on thallus

Sexual Rep. → Male & Female sex organs are produced on either same or different thalli.

Sporophyte develops into foot seta capsule

Gemmae & give free living gametophyte

begin. Anisogam. begin. forming two distinct gametes.

MOSSES

Location: Moist, shaded areas.

Predominant stage of life cycle → Gametophyte

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Develops directly from spore

- Creeping
- Green
- Branched
- Frequently filamentous.

Eg. Funaria, Polytrichum, Sphagnum

Veget. Reproduction → By fragmentation & budding in sec. protonema

Sexual Rep. → At the apex of leafy shoot

* Sporophyte in mosses antlerlike more elaborate than liverworts.

* Mosses have elaborate mechanism of spore dispersal.

Protonema

Leafy stage
Develops from sec. protonema as lateral bud.

- Upright
- Slender axes
- Born sparsely on a ped. leaves
- Rhizoids: Branched multicellular organs.

This stage bears sex organs.

budding in sec. protonema

Zygote → Androgonium

↓

develops into sporophyte

Foot seta capsule

capsule contain spores

(Mosses)

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PTERIDOPHYTES

horsetails

Ferns

Uses → medicinal purposes
soil-binders
Ornamentals.

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* Evolutionary, they are first terrestrial plants possess vascular tissues - xylem & phloem.

Location: Cool, Damp, Shady Places

They may flourish well in sandy-soil conditions.

Main plant Body: Sporophyte

differentiated into

True → (Root Stem Leaves)

→ These organs possess well differentiated vascular tissues.

Leaves: Small (microphylls) → Selaginella

Large (macrophylls) → Ferns

* Sporophytes → sporangia → suboned by a leaf like appendages → sporophylls

In some cases

Form ① distinct (strobili) → Strobili/Cones
② compact / axes

→ Selaginella
Equisetum

meiosis in SMC

→ produce spores → germinate

multicell. ← MIS
Inconspic. → small

Inconspicuous
small multicellular
Free living
Mostly photosynth.
Thalloid

Free living → Foremost
mostly photosynthetic → Thalloid

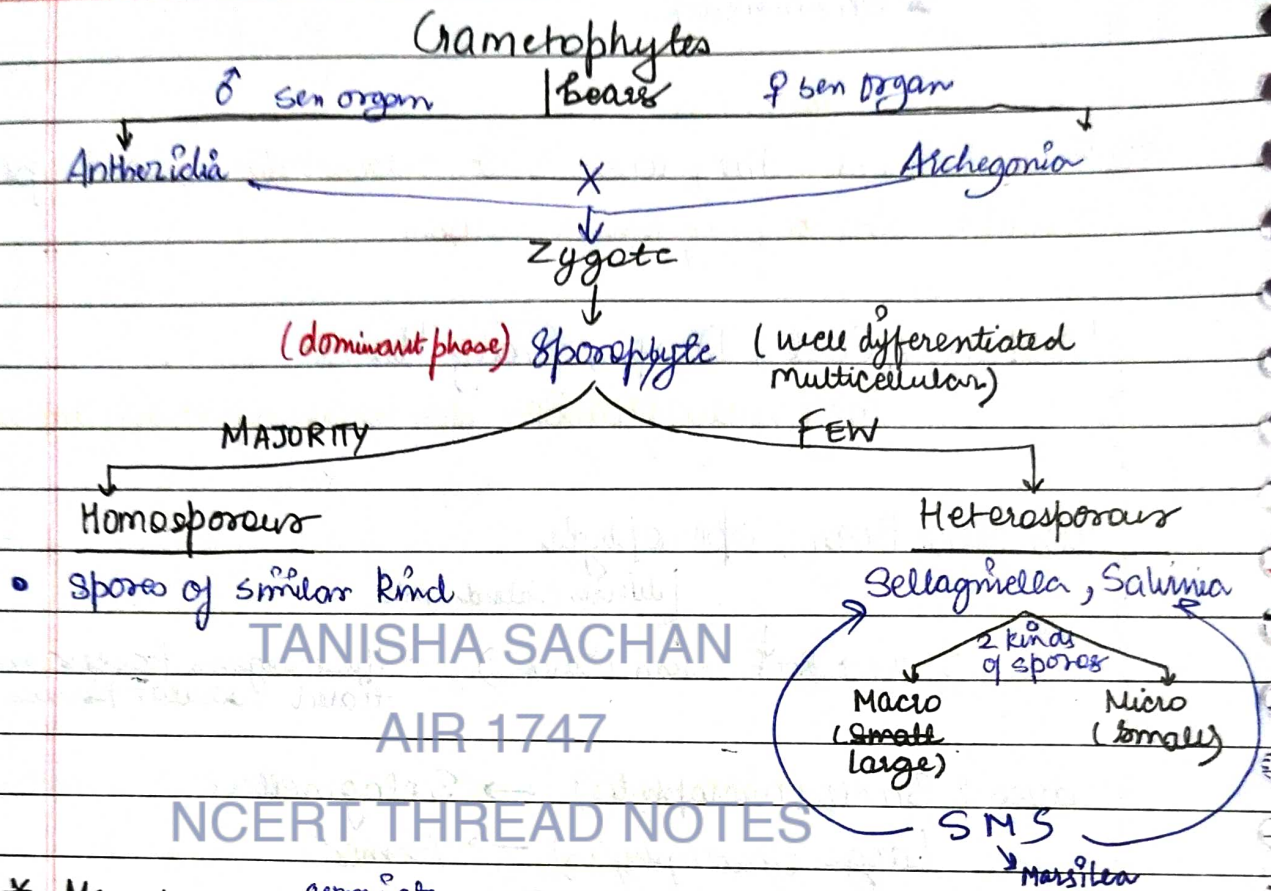
→ gametophyte
" PROTHALLUS "

Because of the specific restricted requirement - and the need for water for fertilization, the spread of living pteridophytes is limited and restricted to narrow geographical regions.

Require cool, damp, shady places to grow.

Water required → transfer of antherozoids → To mouth of archegonium.

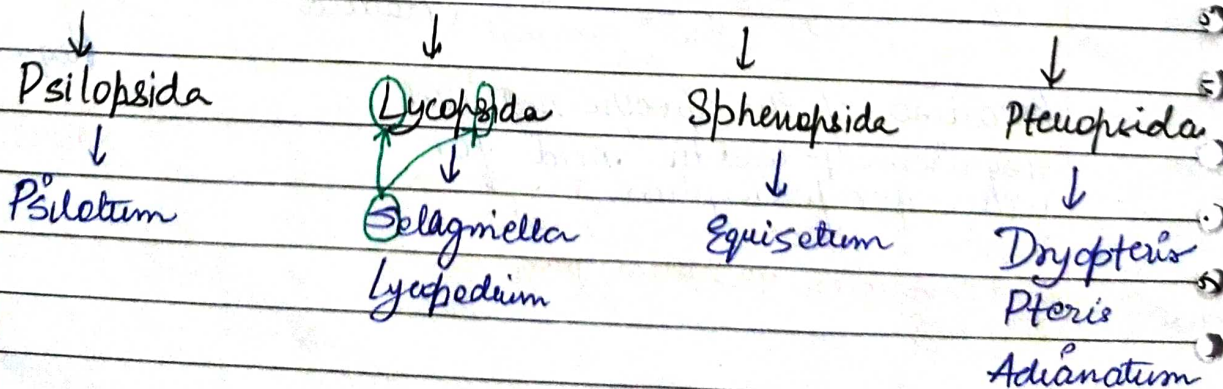
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* Megaspore $\xrightarrow{\text{germinate}}$ Female gametophyte
Microspore $\xrightarrow{\text{germinate}}$ Male gametophyte.

"The female gametophyte in these plants are retained on the parent sporophyte for variable periods."

"The development of zygotes into young embryos take place within the female gametophytes." This event is a precursor to the seed habit → imp step in evolution.



GYMNOSPERM

Gymnos: naked.
sperma: seeds

"Naked seeded plants"

"Ovules are not enclosed by any ovary wall & remain exposed before & after fertilization."

Post fertilized → seeds → not covered/naked.

Sequoia → one of the tallest tree species.
(Redwood tree)

(1) Roots: Generally tap roots in general (some) have fungal associating

Pinus
Mycorrhiza

Cycas
Small specialized coralloid roots are associated with N_2 fixing cyanobacteria.

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(2) Stems: → Unbranched → Cycas
→ Branched → Pinus, Cedrus

Cycas
Unbranched

(3) Leaves: → simple
→ compound.
Withstand temp
humidity
wind

Conifers

- needle like leaves
- Reduces surface area
- Thick cuticle
- sunken stomata
- Help reduce water loss

Cycas

Pinnate leaves
→ persists for a few years.

Gymnosperms → HETEROSPOROUS

Microspore

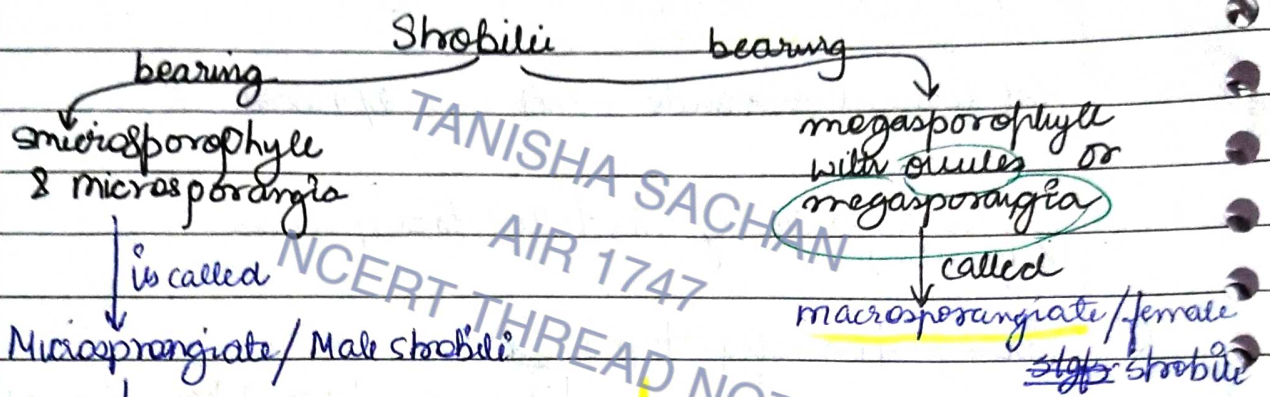
Megaspore

(Haploid)

"Prod. within sporangia that are borne on Sporophylls"

arranged spirally on the axis to form lam or compact strobili or cones.

Lax → sporophylls → sporangia



↓
microspore
↓ this develops
into male gametophyte —
which is highly reduced
& is confined to only a limited
number of cells.

Reduced male gametophyte → pollen grain
microsporangia ← their development takes place inside

* "The male or female cones or strobili may be borne on same tree - Pinus"

* "In cycas, male cones and megasporophylls are borne on diff. trees"

* Megaspore mother cell is differentiated from one of cells of nucellus (1 MMC) born on megasporophyll, clustered to form female cones. protected by envelopes

↓ meiosis
4 megaspore

↓ Only one megaspore
enclosed within megasporangium
develops into a multicellular female gametophyte that bears two or more archegonia / ♀ sex organ. The multicellular female gametophyte is retained within megasporangium.

Unlike bryoph. & pteridoph. gymnosperm, the ♂ & ♀ gametophytes do not have INDEPENDENT FREE LIVING EXISTENCE.

↓
"They remain within sporangia retained on sporophytes"

Pollen grain → Released from microsporangium → Carried by air currents

zygote ← embryo
Ovules → seeds (not covered)

↓
come in contact with the opening of ovules born on megasporophylls

Fertilization ← discharge their contents near mouth of archegonia
Pollen tube carrying male gametes grows towards archegonia in the ovules

ANGIOSPERMS

Pollen grains & ovules $\xrightarrow{\text{developed in}}$ flowers (specialised structure)

→ seeds are enclosed in fruits

→ exceptionally large gyps

→ wide range of habitats

→ Size: Walfia to tall trees Eucalyptus (100m high)
(smallest)

→ Provide us: food, fodder, fuel, medicine 98.3 f.m. → medicine
fuel food fodder

Classes

Dicots

- Seeds with two cotyledons.
- Reticulate venation
- Tetramerous/pentamerous flowers
↓ or ↓
(4 or 5 members in each whorl)

Monocots

- seeds with single cotyled
- Parallel venation
- Trumerous

Male sex organ: Stamen → slender filament
→ (anther) at tip.

within these PMC $\xrightarrow{\text{meiosis}}$ microspore $\xrightarrow{\text{mature}}$ pollen grain

Female sex organ: Pistil → ovary → at base
→ long slender style
→ stigma

ovules are present
each ovule
↓ has
Megaspore mother cell

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↓ meiosis
4 haploid megaspore

Three degenerate
One of them divide

embryo sac

3 cell/egg appan

3 antipodal cells

one egg cell

two synergids

Two polar nuclei

Polar nuclei eventually fuse to produce a diploid secondary nucleus.

Pollen grains after dispersal from anther

carried by wind or various other agencies.

To stigma of pistil

Resulting pollen tube grows through the tissues of stigma & style & reach ovule

Pollen tube enter the embryo sac where two male gametes are discharged.

one male gamete

other male gamete

egg cell

Diploid sec. nucleus

Syngamy

Triploid primary Endosperm nucleus (PEN) (Triple fusion)

DOUBLE FERTILIZATION (unique to angiosperm)

Zygote → embryo (with 1/2 cotyledons)

PEN → endosperm (provide nourishment to developing embryo)

Synergids & Antipodals → degenerate after fertilization

Ovule → seeds

Ovaries → fruit

ALTERNATION OF GENERATIONS

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- * In plants, both haploid & diploid cells can divide by mitosis. This ability leads to formation of different plant bodies — haploid & diploid.

↓
produce gametes by mitosis

↓
produce spores by meiosis

germination by mitosis → To form haploid plant body.

- * There is an alternation of generations b/w gamete producing haploid gametophyte & spore producing diploid sporophyte.

HAPLONTIC → Many algae as volvox, Spirogyra
Some species of Chlamydomonas

- * Sporophytic Generation is represented only by one celled zygote

- * No free living sporophytes

- * Meiosis in Zygote → haploid spores mitotically → gametophyte (Dominant, Free living Photosynthetic)

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DIPLONTIC → Gymno & Angio, An alga - Fucus sp.
with some variations

- * Diploid sporophyte → Dominant, Independent / free living Photosynthetic

* Gametophyte is represented by single to few celled haploid gametophyte.

HAPLODIPLONTIC → Both the phases - multicelled.

Bryophytes

Pteridophytes

Gametophyte (n) → Dominant
Independent
Photosynthetic
Thalloid
Erect

Multicelled
~~Saprophytic/Autotrophic~~
Independent
Short lived

Sporophyte → Short lived multicelled
Partially or totally dependent on gametophyte for

anchorage nutrition

Dominant
Independent
photosynthetic
Vascular

Algae → Ectocarpus, Polysiphonia, Kelps.

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